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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Kohji SAKAI, et al.

SERIAL NO: 09/678,611

GAU: 2712

FILED: October 4, 2000

EXAMINER:

FOR: SCANNING OPTICAL SYSTEM, OPTICAL SCANNING DEVICE AND IMAGE FORMING APPARATUS

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

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SIR:

Applicant(s) wish to disclose the following information.

Technology Center 2600

REFERENCES

- The applicant(s) wish to make of record the references listed on the attached form PTO-1449. Copies of the listed references are attached, where required, as are either statements of relevancy or any readily available English translations of pertinent portions of any non-English language references.
- A check or credit card payment form is attached in the amount required under 37 CFR §1.17(p).

RELATED CASES

- Attached is a list of Applicants' pending application(s) which may be related to the present application. A copy of the claims and drawings of the pending application(s) is attached.
- A check or credit card payment form is attached in the amount required under 37 CFR §1.17(p).

CERTIFICATION

- Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement.
- No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application or, to the knowledge of the undersigned, having made reasonable inquiry, was known to any individual designated in 37 CFR §1.56(c) more than three months prior to the filing of this statement.

DEPOSIT ACCOUNT

- Please charge any additional fees for the papers being filed herewith and for which no check or credit card payment is enclosed herewith, or credit any overpayment to deposit account number 15-0030. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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LIST OF RELATED CASES

<u>Docket Number</u>	<u>Serial or Patent Number</u>	<u>Filing or Issue Date</u>	<u>Inventor/ Applicant</u>
198004US2*	09/678,611	10/04/00	SAKAI et al.
247061US2	10/758,212	01/16/04	SAKAI

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*Present Application; listed for information

GJM/sb

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WHAT IS CLAIMED IS:

1. A synchronous detector that detects timing of scanning by an optical scanner, the optical scanner having a light source that emits a light beam, a deflecting unit that deflects the light beam, a scanning optical element that focuses the light beam deflected by the deflecting unit onto a surface to be scanned, comprising:
 - a photoreceiver; and
 - a synchronous optical element that focus the light beam deflected by the deflecting unit onto the photoreceiver, wherein the synchronous optical element satisfies a relationship $fm < fd$, where fm is a composite focal length of the scanning optical element in a main scanning direction, and fd is a composite focal length of the synchronous optical element in the main scanning direction.
- 10 15 2. The synchronous detector according to claim 1, wherein the synchronous detector comprises a plurality of the synchronous optical elements and a plurality of the photoreceivers, wherein the synchronous optical elements have negative power in the main scanning direction.
- 20 3. The synchronous detector according to claim 2, wherein a plurality of laser beams travel toward the same synchronous detector, and the synchronous optical elements are arranged so as to focus principal rays of the light beams to a single point in a secondary scanning direction.

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Related Pending Application
Related Case Serial No: 10/758,212
Related Case Filing Date: 01-16-04

4. The synchronous detector according to claim 1, wherein the synchronous optical element is a single lens that is designed such that one surface thereof is a cylindrical surface that is concave in the main scanning direction, and the other surface thereof is a rotationally symmetric surface.

5. An optical scanner comprising:

a light source that emits a light beam;

a deflecting unit that deflects the light beam;

10 a scanning optical element that focuses the light beam deflected by the deflecting unit onto a surface to be scanned; and

a synchronous detector that detects timing of scanning by an optical scanner, the synchronous detector including

a photoreceiver; and

15 a synchronous optical element that focus the light beam

deflected by the deflecting unit onto the photoreceiver, wherein the

synchronous optical element satisfies a relationship $fm < fd$, where fm is a composite focal length of the scanning optical element in a main scanning direction, and fd is a composite focal length of the

20 synchronous optical element in the main scanning direction.

6. The optical scanner according to claim 5, wherein the light sources are provided in plurality, each of the light sources emits a light beam,

25 the deflecting units are provided in plurality, each of the

deflecting units deflects a corresponding one of the light beam, and the scanning optical elements are provided in plurality, each of the scanning optical elements focuses the light beam deflected by a corresponding one of the deflecting unit onto a corresponding one of a 5 surface to be scanned.

7. The optical scanner according to claim 6, wherein the optical scanner is a multi-beam optical scanner in which a plurality of light beams pass through the respective optical surfaces of scanning the 10 optical element having a form in which identical optical surfaces are formed on top of one another in a plurality of tiers.

8. The optical scanner according to claim 5, wherein the synchronous detector comprises a plurality of the synchronous optical 15 elements and a plurality of the photoreceivers, wherein the synchronous optical elements have negative power in the main scanning direction.

9. The optical scanner according to claim 8, wherein a plurality of laser beams travel toward the same synchronous detector, and the 20 synchronous optical elements are arranged so as to focus principal rays of the light beams to a single point in a secondary scanning direction.

10. The optical scanner according to claim 5, wherein the synchronous optical element is a single lens that is designed such that 25 one surface thereof is a cylindrical surface that is concave in the main

scanning direction, and the other surface thereof is a rotationally symmetric surface.

11. An image forming apparatus comprising a photoreceptor, an optical scanner that optically scans a surface of the photoreceptor, and a synchronous detector that detects timing of scanning of the photoreceptor by the optical scanner, wherein
 - the optical scanner includes
 - a light source that emits a light beam;
 - 10 a deflecting unit that deflects the light beam; and
 - a scanning optical element that focuses the light beam deflected by the deflecting unit onto a surface to be scanned, and
 - the synchronous detector includes
 - a photoreceiver; and
 - 15 a synchronous optical element that focus the light beam deflected by the deflecting unit onto the photoreceiver, wherein the synchronous optical element satisfies a relationship $fm < fd$, where fm is a composite focal length of the scanning optical element in a main scanning direction, and fd is a composite focal length of the
 - 20 synchronous optical element in the main scanning direction.
12. The image forming apparatus according to claim 11, wherein the synchronous detector comprises a plurality of the synchronous optical elements and a plurality of the photoreceivers, wherein the synchronous optical elements have negative power in the main scanning direction.

13. The image forming apparatus according to claim 12, wherein a plurality of laser beams travel toward the same synchronous detector, and the synchronous optical elements are arranged so as to focus 5 principal rays of the light beams to a single point in a secondary scanning direction.

14. The image forming apparatus according to claim 11, wherein the synchronous optical element is a single lens that is designed such that 10 one surface thereof is a cylindrical surface that is concave in the main scanning direction, and the other surface thereof is a rotationally symmetric surface.

ABSTRACT OF THE DISCLOSURE

A synchronous detector detects timing of scanning by an optical scanner in an image forming apparatus. The optical scanner has a light source that emits a light beam, a deflecting unit that deflects the

5 light beam, a scanning optical element that focuses the light beam deflected by the deflecting unit onto a surface to be scanned. The synchronous detector includes a photoreceiver, and a synchronous optical element that focus the light beam deflected by the deflecting unit onto the photoreceiver. The synchronous optical element satisfies a

10 relationship $fm < fd$, where fm is a composite focal length of the scanning optical element in a main scanning direction, and fd is a composite focal length of the synchronous optical element in the main scanning direction.

FIG.1

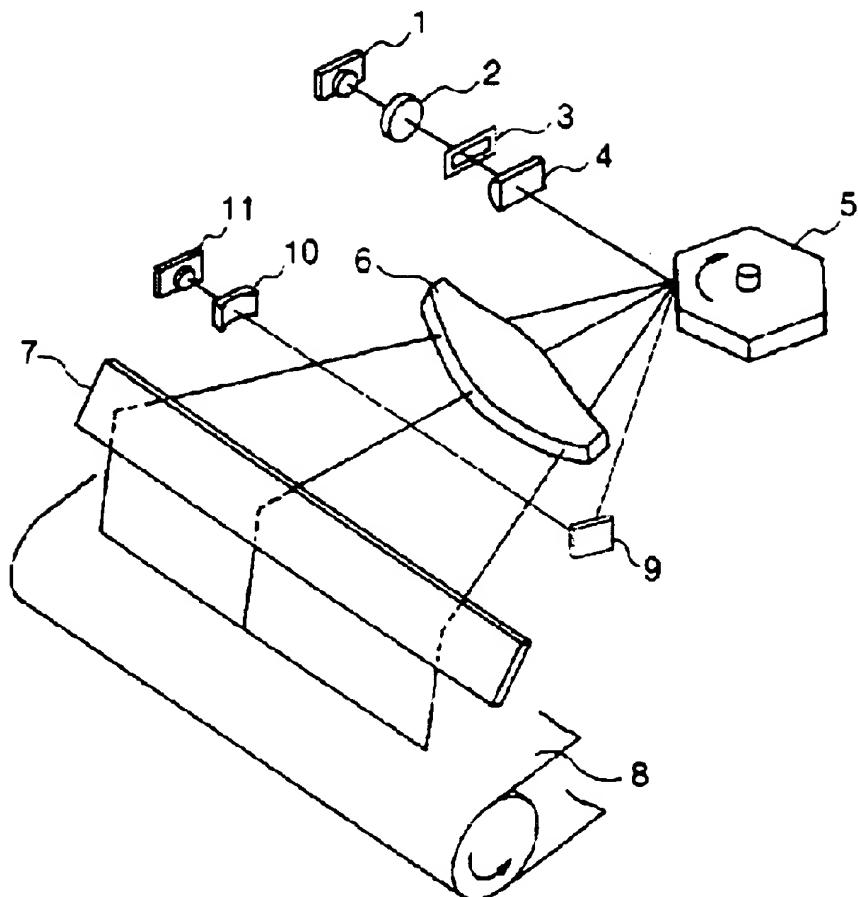


FIG.2

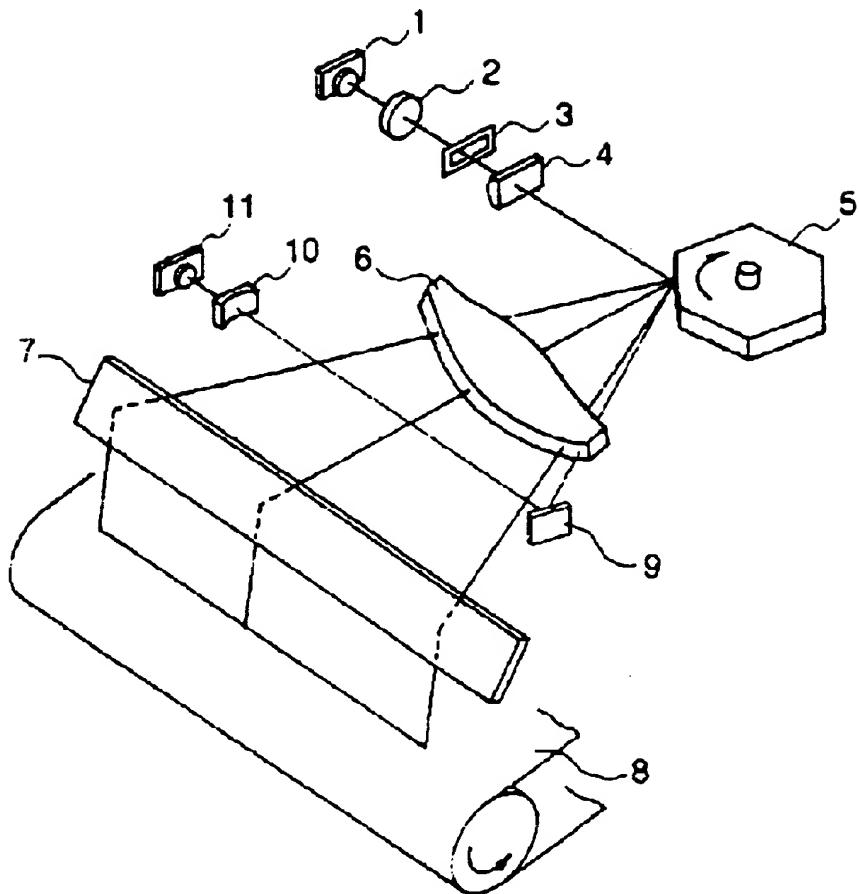


FIG.3

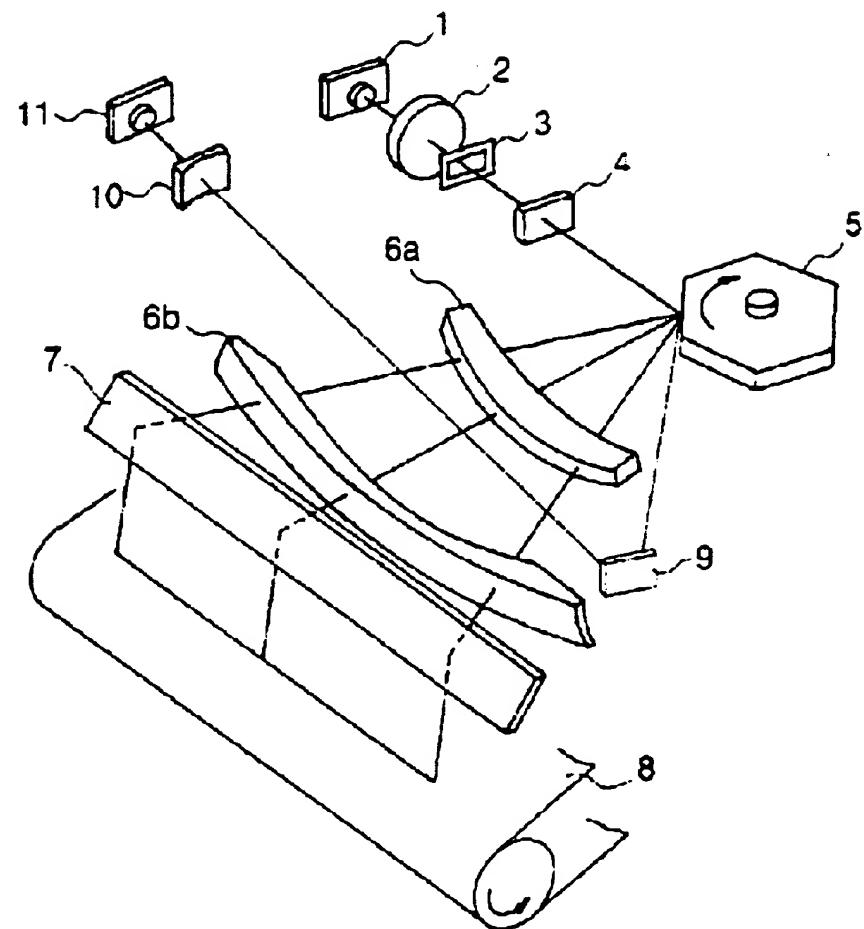


FIG.4

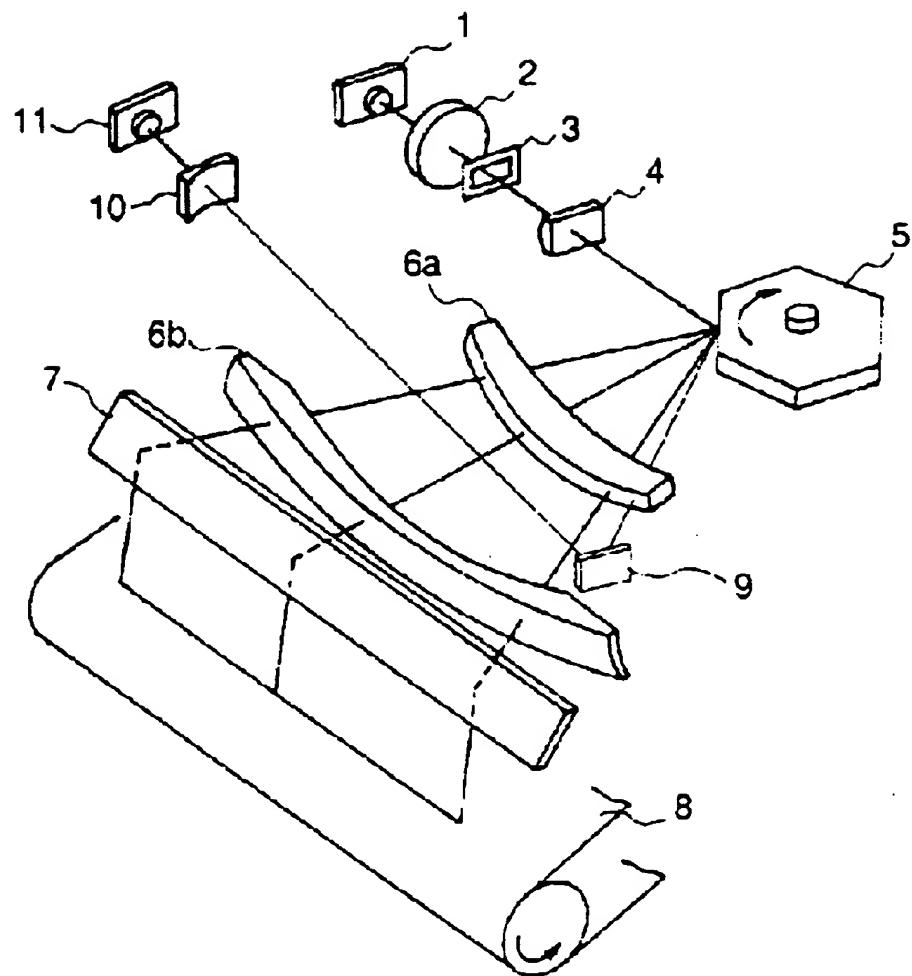


FIG.5

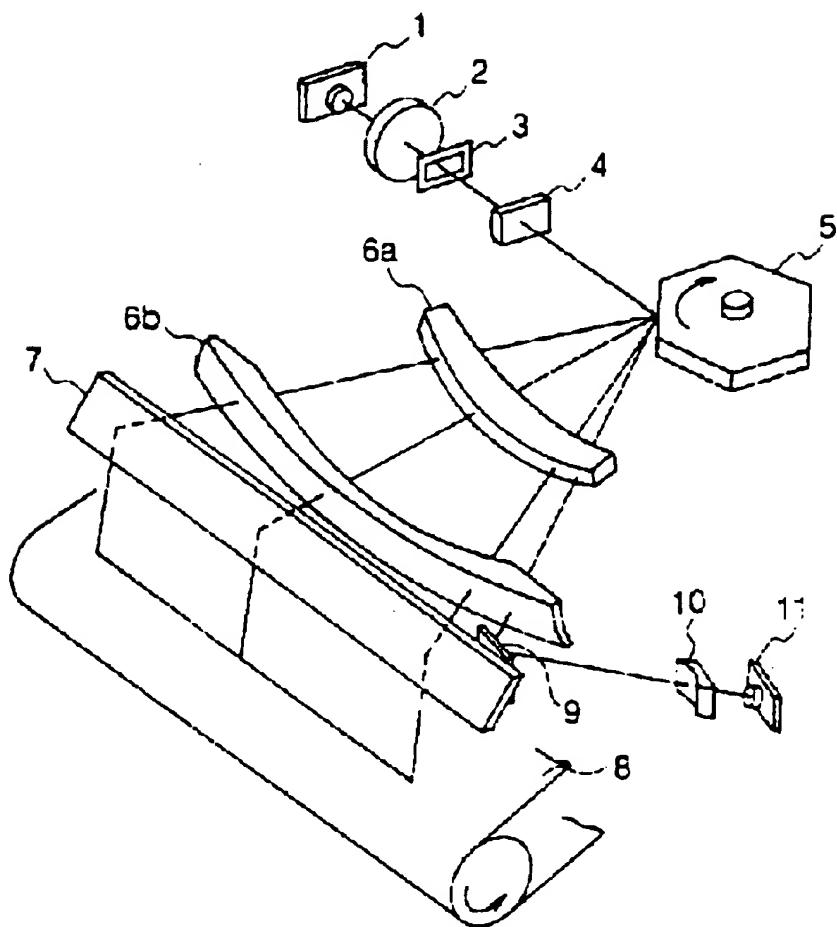


FIG.6

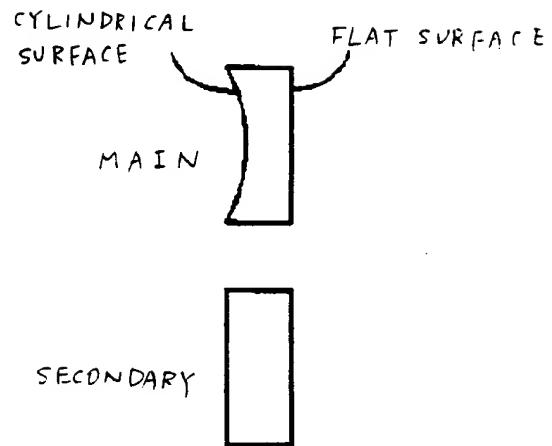


FIG.7

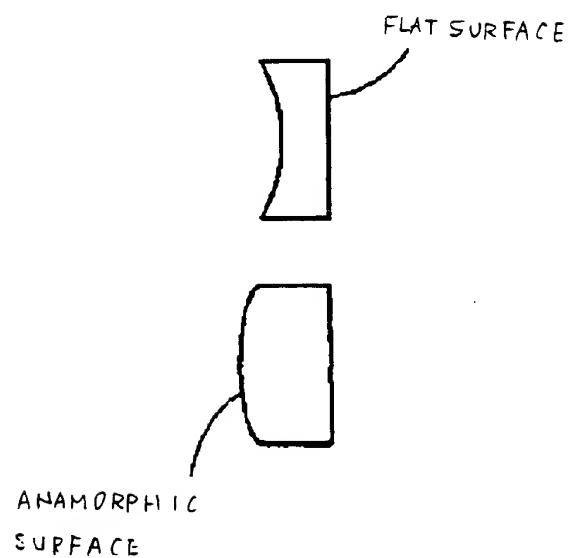


FIG.8

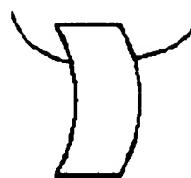
CYLINDRICAL
SURFACE



CYLINDRICAL
SURFACE

FIG.9

CYLINDRICAL
SURFACE



SPHERICAL SURFACE



FIG.10

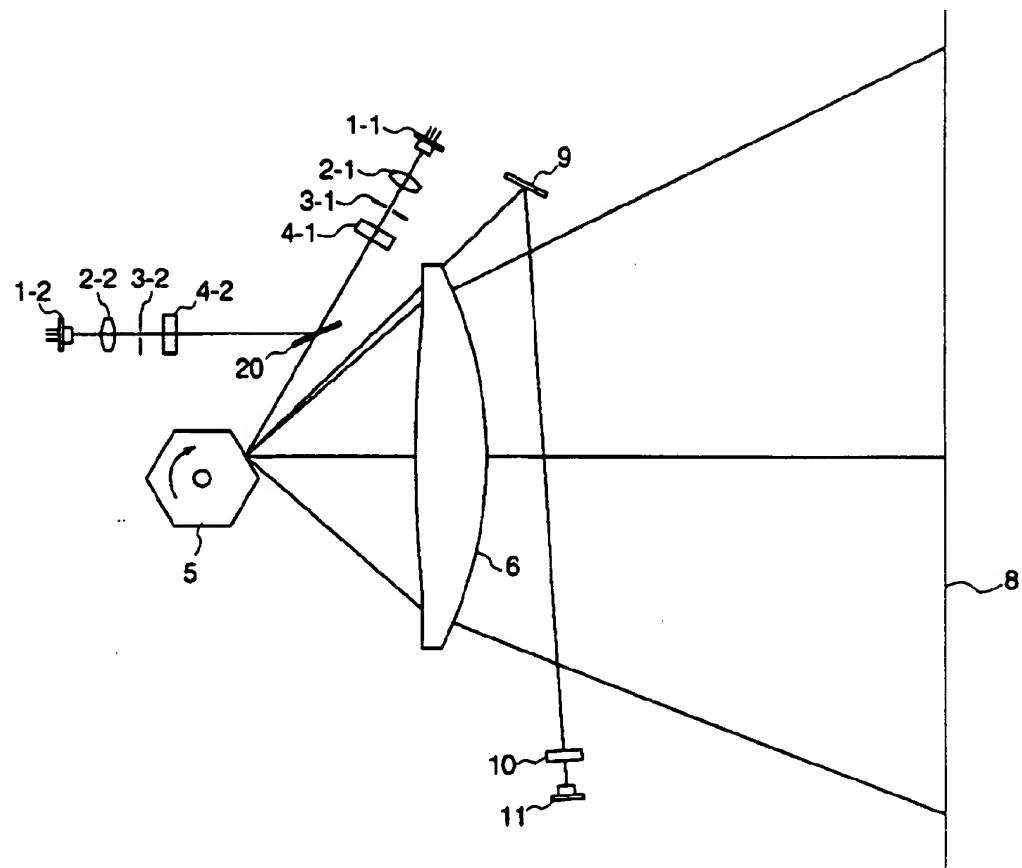


FIG.11

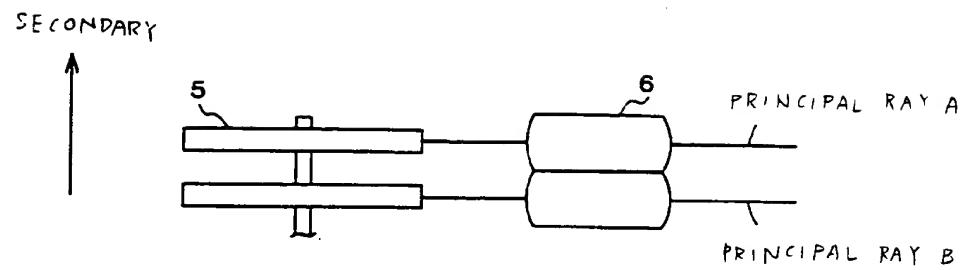


FIG.12

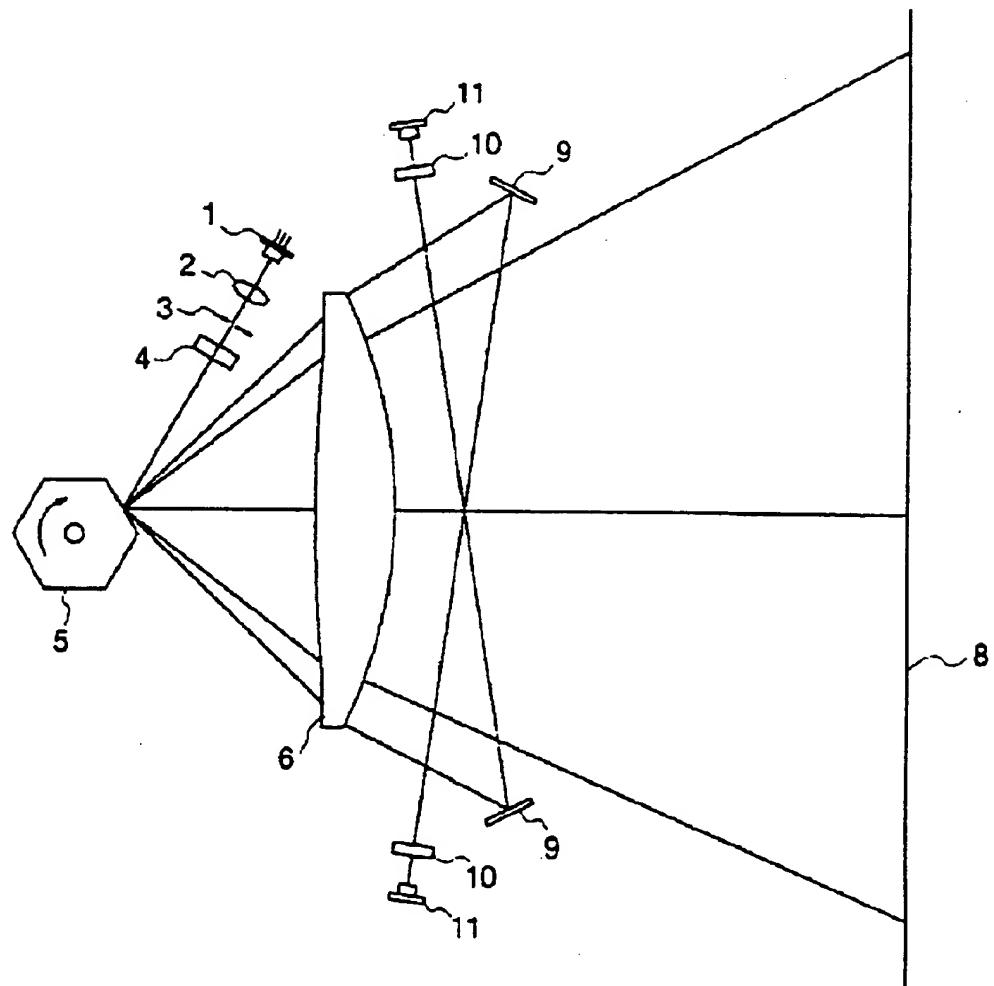


FIG.13

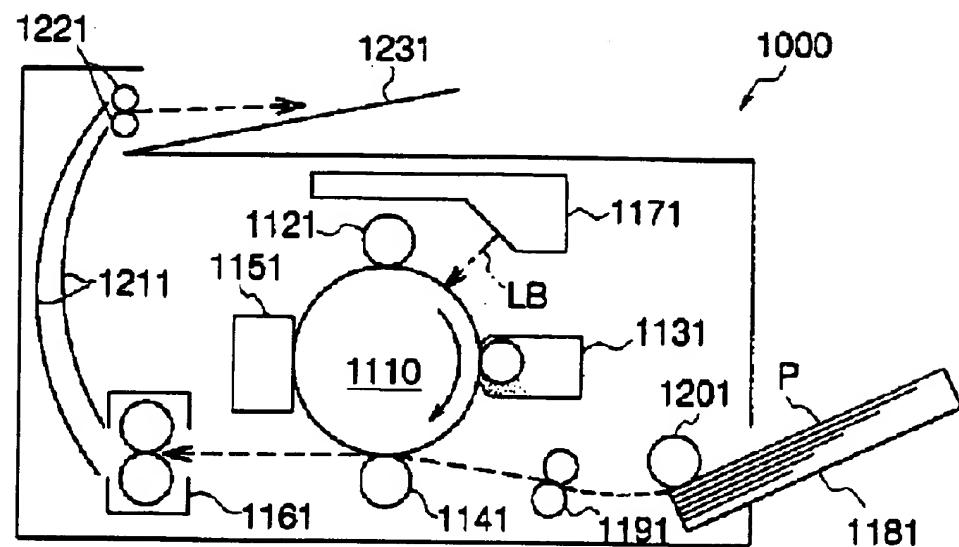


FIG.14

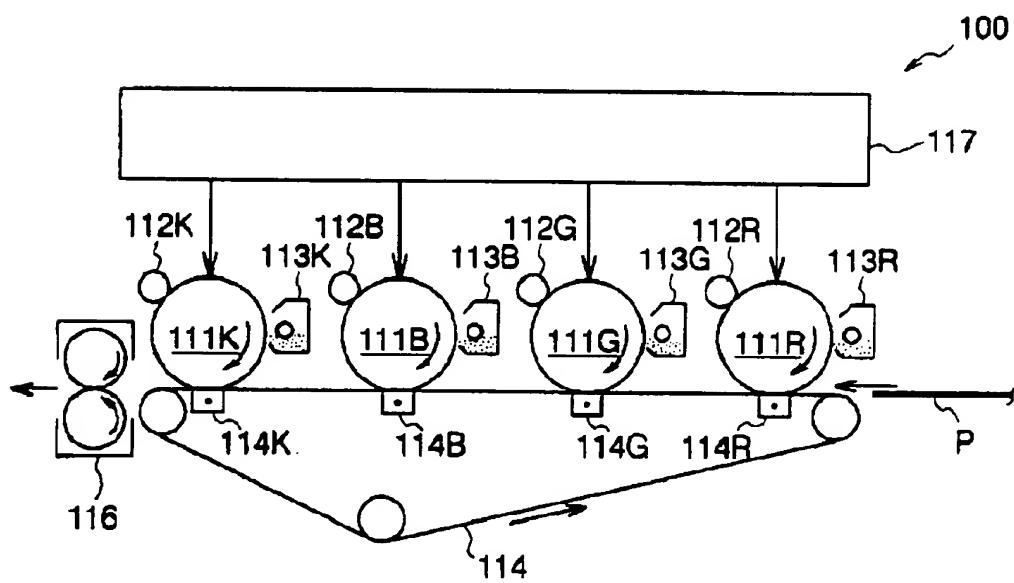


FIG.15

